

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
15 January 2004 (15.01.2004)

PCT

(10) International Publication Number
WO 2004/006259 A1

(51) International Patent Classification⁷: **G11B 23/087**,
23/00, 23/03, 27/11, G06F 1/00

(21) International Application Number:
PCT/IB2003/002728

(22) International Filing Date: 27 June 2003 (27.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
02077715.7 8 July 2002 (08.07.2002) EP

(71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]**;
Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **KAHLMAN, Josephus, A., H., M. [NL/NL]**; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(74) Agent: **DEGUELLE, Wilhelmus, H., G.**; Philips Intellectual Property & Standards, Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

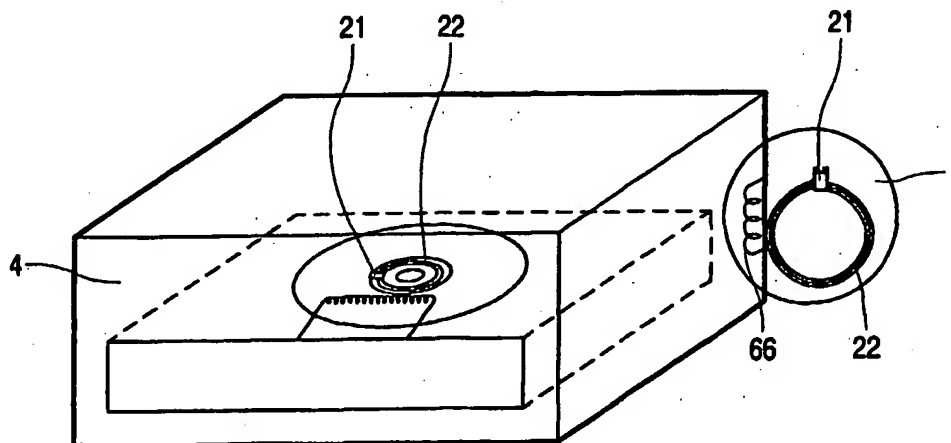
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG,

"[Continued on next page]"

(54) Title: **INFORMATION CARRIER DRIVE DEVICE PROVIDED WITH A DOUBLE ANTENNA**



(57) Abstract: An apparatus is provided for reading an information carrier (1) which has an integrated circuit (21) and an antenna (22) coupled to the integrated circuit. The apparatus has communication means to establish communication between the integrated circuit on the disc and the apparatus. The communication means has two antennas (66,67): one which can communicate with the integrated circuit on the disc when the disc is loaded in the apparatus and one which provides communication between the apparatus and the integrated circuit on the information carrier when the disc is in the vicinity of the apparatus.

WO 2004/006259 A1



ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— with international search report

INFORMATION CARRIER DRIVE DEVICE PROVIDED WITH A DOUBLE ANTENNA

The invention relates to an apparatus for reading out an information carrier, which information carrier is provided with an integrated circuit and an antenna connected to the integrated circuit, said apparatus being provided with communication means for achieving an electromagnetic coupling with the antenna on the information carrier.

5

An apparatus as described in the opening paragraph is known from US patent US 6,044,046. In this system, an integrated circuit (denoted chip hereinafter) is provided on an information carrier for the purpose of storing additional information. The information carrier may be, for example, a disc with an optical storage unit, such as a CD or DVD. These discs may be used for storing and filing comparatively large quantities of data in a simple manner, for example digital photos, films, and music albums. This information, which is protected by copyright, i.e. the digital work, can be stored in an encoded manner on the information carrier so as to counteract illegal distribution. The additional information stored in the chip is, for example, a decoding key with which the encoded digital work on the information carrier can be decoded.

10
15

The information carrier is to be loaded into the playback apparatus if the digital work stored on the information carrier is to be reproduced. The playback apparatus comprises optical reading means which render possible the read-out of the optical storage unit.

20

The chip is provided with electromagnetic receiver means for obtaining the energy necessary for the operation of the chip. Electromagnetic transmitter and receiver means are furthermore present on the chip of the information carrier so as to render possible a communication between the chip and the playback apparatus.

25

Communication means rendering possible this communication are present in the playback apparatus. The communication means in the apparatus are formed, for example, by an integrated circuit, a so-termed read-out IC, and an antenna. The communication means in the existing system are designed such that communication can take place between the chip

on the information carrier and the read-out IC in the apparatus only if the information carrier is present inside the apparatus.

5 It is a disadvantage of the known apparatus that the communication between the chip and the read-out IC can only take place when the information carrier is present in the playback apparatus.

10 It is an object of the invention to provide an apparatus of the kind mentioned in the opening paragraph which renders possible a communication between the chip and the read-out IC which is not limited to a fixed position of the information carrier in the playback apparatus.

15 This object is achieved in that the communication means are constructed such that the communication between the integrated circuit and the apparatus can take place both when the information carrier is present inside the apparatus and when the information carrier is present in the vicinity of the apparatus.

20 The invention is based on the recognition that it is favorable in some cases to render possible a communication with the chip on the information carrier also in the vicinity of the playback apparatus. The information stored in the chip may be, for example, the table of contents of the information carrier. If the stored digital work comprises, for example, music albums, such an information carrier will quite probably comprise dozens of titles. It would be very convenient for the user of the system if he/she could read the table of contents by just holding the information carrier close to the playback apparatus. The communication
25 means in the playback apparatus may then display this information, for example, on a screen. The user can obtain the desired data easily and quickly in this manner.

30 In an embodiment of the apparatus according to the invention, the communication means of the apparatus comprise at least two antennas. One of these antennas is present, for example, on the pressure body of the playback apparatus. This position renders it possible for the chip on the information carrier to be read when the information carrier is inside the apparatus. A further antenna will then be located, for example, on or adjacent an outer wall of the apparatus. The location of this antenna renders it possible to communicate with the chip also outside the apparatus.

An embodiment of the apparatus according to the invention is characterized in that at least two antennas are coupled to one read-out IC.

The advantage of this measure is that the cost of the communication means present in the apparatus can be reduced.

5 In the prior-art system, the communication means in the playback apparatus comprise one read-out IC connected to one antenna. These means are capable of achieving an electromagnetic coupling with an antenna on the information carrier. If a second antenna is desired in the apparatus, for example for reading the table of contents without having to load the information into the apparatus, it would seem logical to use an additional read-out IC
10 connected to an additional antenna. The embodiment is based on the recognition that the cost of the communication means can be reduced in that one read-out IC is used, to which two antennas are coupled.

15 These and further aspects of the apparatus according to the invention will be explained in more detail below with reference to drawings, in which:

Fig. 1 is a diagrammatic plan view of an embodiment of the information carrier,

Fig. 2 is a diagrammatic cross-sectional view of the embodiment of the
20 information carrier taken on the line II-II in Fig. 1,

Fig. 3 is a diagrammatic elevation of a system comprising an apparatus for reading the information carrier,

Fig. 4 is a diagrammatic elevation of an embodiment of the apparatus,

Fig. 5 is a circuit diagram of the communication means of the apparatus and
25 the chip and antenna on the information carrier, and

Fig. 6 is a circuit diagram of an embodiment of the apparatus according to the invention.

30 Furthermore, the mutual dimensional ratios of the components have not been necessarily exactly depicted in the Figures for reasons of clarity, where applicable. It will be clear to those skilled in the art that alternative but equivalent embodiments of the invention are possible without departing from the essence of the invention, and that the scope of the invention is limited by the claims only. Thus the embodiments described below relate to an

information carrier with an integrated circuit, such as a DVD. It will be obvious that the principles of the invention may be equally well applied to other rotating information carriers such as CD-R, CD, DVD+ RW, CD-I, and other members of the family of optical information carriers. It will also be obvious to those skilled in the art that the description
5 given below of embodiments of a playback apparatus is also applicable to a recording apparatus for writing on the optical storage unit.

Fig. 1 shows the information carrier that can be read out by the apparatus according to the invention. The information carrier in this example is a disc with an optically
10 readable storage unit. The information carrier 1 is provided with a center hole 11 situated in the center of the disc. Several areas are defined on the information carrier 1, furthermore, which areas may each have, for example, different physical properties. The disc comprises a clamping area 12 which is used for clamping the disc between two bodies. This clamping renders it possible for the disc to move and rotate about the center of the disc in a contactless
15 manner. This will be described in more detail below when the system is discussed. Furthermore, an information area 13 is defined on the disc, where the optically readable storage unit is present. This storage unit comprises a track which is arranged in a spiraling or concentric pattern. It is possible to read the track on the information carrier by means of a read head known to those skilled in the art. The read head comprises inter alia an optical
20 system for focusing a light beam, for example generated by a laser diode. The optical storage unit is built up from several layers, among them a polycarbonate layer and a metal layer. A transitional region 14 is present between the clamping area 12 and the information area 13. The transitional region 14 is also constructed with the polycarbonate layer and the metal layer in the prior art. The transitional region 14 is denoted the CiD region hereinafter.

25 The optical information carrier 1 further comprises an integrated circuit 21 and an antenna 22 which is connected to the integrated circuit (denoted chip hereinafter) 21. An embodiment of the information carrier with the chip and the antenna shown in the CiD region can be seen in Fig. 2. The antenna is preferably a coiled antenna. The antenna is always located in the CiD region. There are no limitations as to the positioning of the chip, for
30 example, it is possible to position the chip in the information area, but the CiD region is preferred. The chip is, for example, a MiFare RFID chip manufactured by Philips Electronics N.V. and is also described in the RFID HANDBOOK, p. 282 by Klaus Finkenzeller, published by John Wiley & Sons.

The chip provides the possibility of storing information. This information may be, for example, a decoding key for decoding the digital work stored in coded form on the information carrier. The illegal copying and distribution of the digital work on the information carrier is rendered more difficult through the provision of the decoding keys in a separate memory, and not on the information carrier itself. Another example of the use of the storage capacity in the chip is the storage of a table of contents. This table of contents may comprise all titles and performing artists of musical numbers stored on the information carrier in the case in which the digital work comprises, for example, a plurality of music albums. This information in the chip may then be read out, for example, and displayed on a screen.

The chip and the antenna are capable of achieving an electromagnetic coupling to another antenna connected to a read-out IC in a playback apparatus, as will be explained in more detail in the discussion of the system.

To promote the communication between the chip on the disc and the read-out IC, no metal layer is present in the CiD region. The metal layer is shown hatched in the plan view of an embodiment of the information carrier in Fig. 1. No eddy currents interfering with the electromagnetic coupling will arise because no metal layer is present adjacent the antenna.

Fig. 2 is a diagrammatic cross-sectional view of the first embodiment of the information carrier taken on the line II-II in Fig. 1. The optical information carrier in this embodiment is in the form of a DVD. As is known to those skilled in the art, the layered structure of this disc is such that pits and lands are formed in the polycarbonate layer 31. The binary data are encoded in these pits and lands. A reflecting metal layer 32 is laid over this polycarbonate layer. This combination of layers has a thickness of 0.6 mm. An additional polycarbonate layer 33 is provided on top of these layers for obtaining an additional strength and protection.

The antenna 22 is located in the CiD region 14 and is provided at the upper side of the disc. Although this embodiment is preferred because of the comparatively simple adaptation of the production process of optical information carriers, it is alternatively possible to provide the antenna between the layers of the disc. The antenna is then shaped in that a continuous metal layer is sputtered, from which the antenna wires are cut out by means of laser technology. The provision of the antenna on top of the disc may take place, for example, by means of a sticker. Conductive current wires are positioned in a coiled pattern on an adhesive layer and then fastened to the disc. These conductive wires form the antenna

and are directly connected to the chip on the information carrier. As will be apparent to those skilled in the art, the antenna may alternatively be fastened to the lower side of the information carrier, i.e. the same side from which the optical storage unit is also read.

The metal layer 32 is present in the information area and not in the CiD region. This promotes the communication between the chip and the read-out IC. Since no metal layer is situated adjacent the antenna, no eddy currents will arise which interfere with the electromagnetic coupling.

As those skilled in the art will understand, the same principle may be applied to other optical information carrier families such as the CD family and the DVR family, in which the metal layer is at different levels in the disc.

Fig. 3 is a diagrammatic cross-sectional view of an embodiment of a system comprising the information carrier and an apparatus. The apparatus comprises inter alia reading means (not shown), for example a read head for reading out information from the optical storage unit. The apparatus further comprises a carrier body 61 on which the information carrier 1 can be laid. A pressure body 62 is subsequently fastened on the information carrier 1 so as to clamp the information carrier. The carrier body has a shaft that is passed through the center hole of the information carrier 1. The pressure body is fastened to the shaft of the carrier body. In this configuration, therefore, the information carrier is between the carrier body 61 and the pressure body 62. The information carrier makes contact with the carrier body and the pressure body in the clamping area of the information carrier. The pressure body is positioned in a bridge 63 in which it can move freely in the direction of the carrier body and can rotate about the axis of the carrier body. Furthermore, the apparatus comprises an electric motor 64 which is fastened to the carrier body and is arranged such that the information carrier 1 rotates in the apparatus, as is known to those skilled in the art.

The apparatus further comprises communication means for establishing an electromagnetic coupling with an information carrier 1 provided with an antenna and a chip as described above and shown in Fig. 1. The communication means of the apparatus comprise a read-out IC 65 and another antenna 66. The read-out IC is, for example, a MiFare RFID ReaderIC manufactured by Philips Electronics N.V. and is also described in the cited RFID HANDBOOK by Klaus Finkenzeller. This ReaderIC operates at 13.56 MHz, which corresponds to a wavelength of the electromagnetic waves of approximately 22 m. Since the distance between the two antennas is many times smaller than 22 m, all may be regarded as magnetic flux. The antenna 66 of the communication means in the apparatus is connected to the ReaderIC and has a coil-type or concentric character.

The antenna 66 of the communication means of the apparatus is preferably arranged perpendicularly above the antenna on the information carrier so as to obtain an optimum coupling. This coupling must be achieved inter alia when the information carrier is in the apparatus and the optical storage unit of the information carrier is being read out. The antenna in the apparatus may be fastened, for example, to the bridge 63 perpendicularly above the antenna on the information carrier as shown in Fig. 6. It will be clear to those skilled in the art that alternative embodiments are also possible.

Fig. 4 diagrammatically shows how the playback apparatus 4 is equipped with two antennas 66 connected to at least one read-out IC 65. The second antenna 66 is located such that it is possible to read out the chip on the information carrier through electromagnetic coupling when the information carrier is outside the apparatus. The second antenna is provided, for example, at the upper side of the apparatus or at the lateral side thereof, as shown. It is sufficient then to hold the information carrier in the vicinity of the antenna for reading of, for example, the table of contents stored in the chip. In an embodiment of the invention, the second antenna has two turns of 70 mm diameter. The antenna on the information carrier has a diameter of approximately 40 mm when it is placed in the region between the clamping area and the information area. The larger diameter of the second antenna providing for communication between the apparatus and the chip on the information carrier outside the apparatus creates a larger area in which it is possible to read out the chip. If the MiFare chip mentioned above is used, it is possible to realize an electromagnetic coupling over a distance of a few centimeters between the antenna in the apparatus and the antenna on the chip, and thus to communicate.

The placement of the second antenna is not bound to a fixed location. It is possible to place the antenna in any position adjacent the periphery of the apparatus. In an embodiment of the invention, there is no metal between the second antenna and the periphery of the antenna. This has the advantage that the communication between the antennas is promoted in that no eddy currents arise because of the absence of the metal layer.

Fig. 5 is a circuit diagram of the communication means of the apparatus and the chip and antenna on the information carrier. As is known to those skilled in the art, a current changing in time through a first coil will generate a magnetic flux which also changes in time. The inductance law states that a voltage will be induced in the first coil, but also in a second coil if the latter comprises a portion of the generated magnetic flux.

The changing magnetic flux in the antenna 66 connected to the read-out IC 65 induces a voltage in the antenna 22 connected to the chip 21 on the information carrier 1

owing to the mutual induction. Communication can thus take place between the chip on the information carrier and the read-out IC in the apparatus by means of electromagnetic coupling.

- 5 An embodiment of the apparatus according to the invention is shown in Fig. 6. The communication means of the apparatus are now constructed such that they comprise two antennas, one for communication when the information carrier is present inside the apparatus, and one for communication when the information carrier is adjacent the apparatus. These two antennas are coupled to one read-out IC. This embodiment has the advantage that the cost of
- 10 an extra read-out IC is saved.

CLAIMS:

1. An apparatus for reading out an information carrier, which information carrier is provided with an integrated circuit and an antenna connected to the integrated circuit, said apparatus being provided with communication means for achieving an electromagnetic coupling with the antenna on the information carrier, characterized in that the communication means are constructed for achieving communication between the integrated circuit and the apparatus when the information carrier is present inside the apparatus and for achieving communication between the integrated circuit and the apparatus when the information carrier is present in the vicinity of the apparatus.
2. An apparatus as claimed in claim 1, characterized in that the communication means comprise at least two antennas, one for communication when the information carrier is inside the apparatus and one for communication when the information carrier is present in the vicinity of the apparatus.
3. An apparatus as claimed in claim 2, characterized in that at least two antennas are coupled to one read-out IC.
4. An apparatus as claimed in claim 3, characterized in that the two antennas are connected in series and coupled to the read-out IC.
5. An apparatus as claimed in claim 2, characterized in that the housing of the apparatus is at least partly free from metal at the area of the antenna for communication between the chip and the apparatus when the information carrier is in the vicinity of the apparatus.

1/3

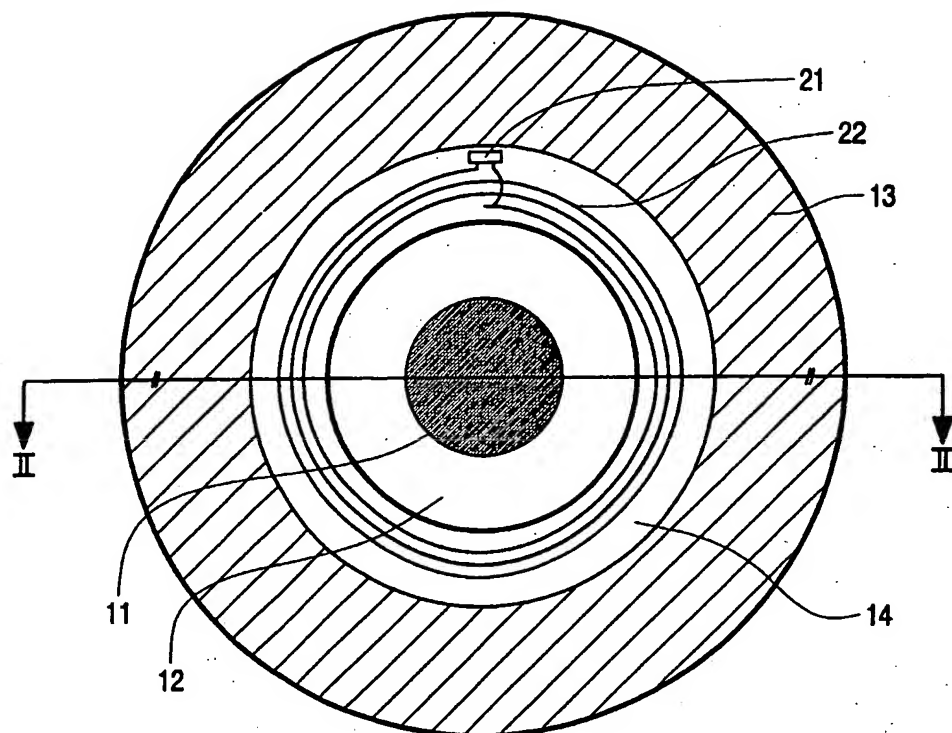


FIG. 1

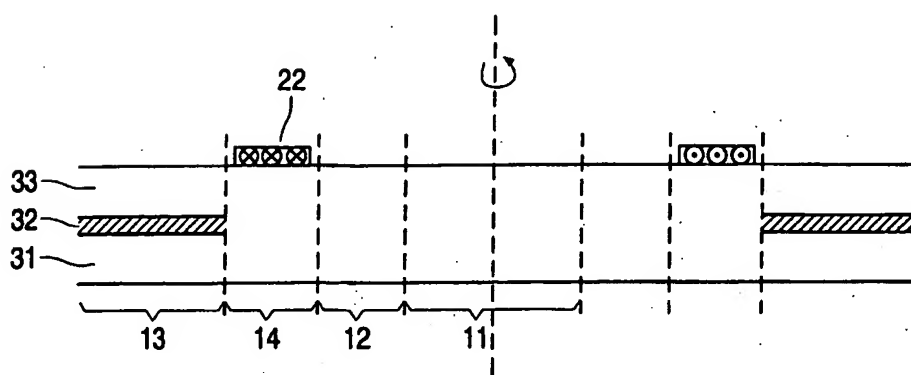


FIG. 2

2/3

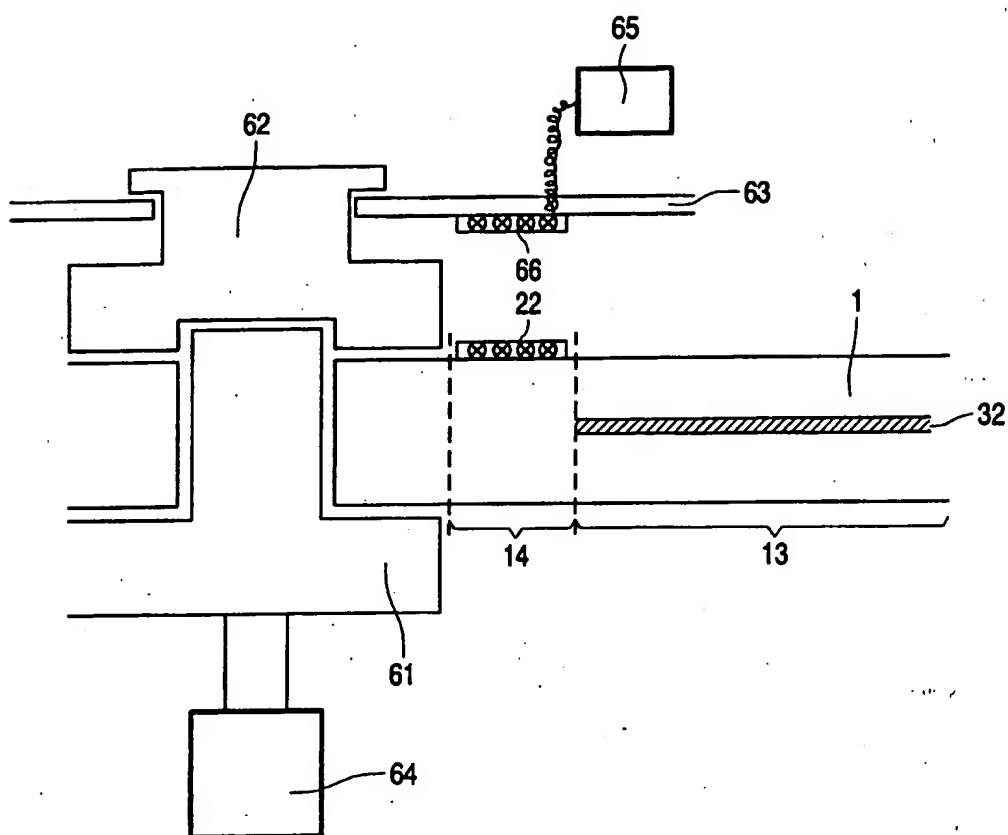


FIG.3

3/3

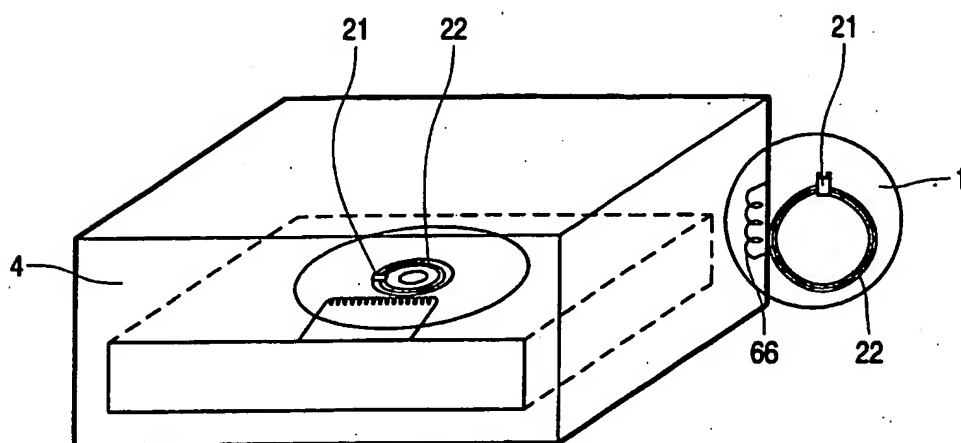


FIG. 4

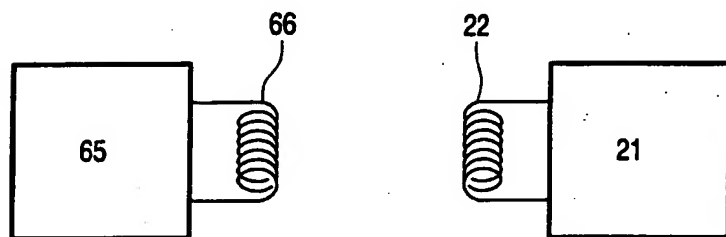


FIG. 5

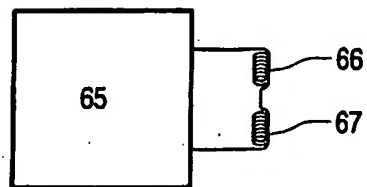


FIG. 6

INTERNATIONAL SEARCH REPORT

Internationa Application No

PCT/IB 03/02728

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G11B23/087 G11B23/00 G11B23/03 G11B27/11 G06F1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G11B G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 93 00680 A (SIEMENS NIXDORF INF SYST) 7 January 1993 (1993-01-07) page 7, paragraph 2 -page 8, paragraph 2; figures 1-3	1-5
Y	US 6 044 046 A (DIEZMANN NILS ET AL) 28 March 2000 (2000-03-28) the whole document	1-5
Y	US 5 971 281 A (LEONHARDT MICHAEL L ET AL) 26 October 1999 (1999-10-26) column 5, line 10 -column 6, line 43; figures 4-6	1-5
X	EP 0 251 210 A (MEDIA SECURITY INC AND ASSOCIA) 7 January 1988 (1988-01-07) column 5, line 26 -column 6, line 14	1
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

30 September 2003

Date of mailing of the international search report

09/10/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Sozz1, R

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 03/02728

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 762 429 A (ORDICAM) 23 October 1998 (1998-10-23) page 4, line 10 -page 5, line 5; figures 1-5 ---	1-5
A	WO 00 10122 A (3M INNOVATIVE PROPERTIES CO) 24 February 2000 (2000-02-24) page 18, line 18 -page 20, line 19; figure 9 -----	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/TB 03/02728

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9300680	A	07-01-1993	WO 9300680 A1	07-01-1993
US 6044046	A	28-03-2000	DE 19616819 A1	30-10-1997
			AT 216120 T	15-04-2002
			AU 2767497 A	19-11-1997
			DE 59706971 D1	16-05-2002
			DK 895637 T3	01-07-2002
			WO 9741562 A1	06-11-1997
			EP 0895637 A1	10-02-1999
			ES 2175403 T3	16-11-2002
			JP 2000509541 T	25-07-2000
			PT 895637 T	30-09-2002
US 5971281	A	26-10-1999	NONE	
EP 0251210	A	07-01-1988	US 4794470 A	27-12-1988
			CA 1286401 C	16-07-1991
			DE 3773545 D1	14-11-1991
			EP 0251210 A1	07-01-1988
			JP 63066783 A	25-03-1988
FR 2762429	A	23-10-1998	FR 2762429 A1	23-10-1998
WO 0010122	A	24-02-2000	AU 5469099 A	06-03-2000
			BR 9913043 A	08-05-2001
			CA 2338522 A1	24-02-2000
			CN 1312927 T	12-09-2001
			DE 1145189 T1	18-04-2002
			EP 1145189 A2	17-10-2001
			ES 2167290 T1	16-05-2002
			JP 2002522849 T	23-07-2002
			WO 0010122 A2	24-02-2000